US Army Corps
of Engineers
Portland District

EPA
Region 10

Characteristics of Sediment at Gold Beach Boat Basin on the Rogue River

Final Report
December 1992

Characteristics of Sediment at Gold Beach Boat Basin on the Rogue River

Prepared For:
Sediment Management Program
U. S. Environmental Protection Agency
Region 10
Seattle, Washington

Prepared By:
U. S. Army Corps of Engineers
Portland District
Portland, Oregon

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Abstract

Sediment in the Gold Beach boat basin is sandy, clayey silt. Sediment in the area of the western docks contains more silt, clay, volatile solids, TOC and AVS than the eastern dock sediment. All sediment samples were high in chromium and nickel, probably of natural origin. Cadmium, copper, mercury, lead and zinc concentrations were at a levels comparable those found in other coastal marinas. Pesticides and PCBs were undetected. Phenols were detected in only one sample. This same sample contained levels of the PAHs phenanthrene, fluoranthene and pyrene that exceed EPA concern levels. TBT concentrations are low and similar to those of other coastal marinas. In general the material is typical of Oregon coastal marina sediment except for its unusually high chromium and nickel content.

Introduction

1. The Gold Beach Boat Basin is located in Gold Beach, Oregon on the south shore of the mouth of the Rogue River. The boat basin is approximately 32 miles north of the California State border and 264 miles south of the mouth of the Columbia River. The basin is located along the south shore of the 1,575 acre estuary of the lower Rogue (1). Sediments in the area are fluvial and contain metallic minerals such as gold, chromite, magnetite, platinum and zircon.

2. The economy of the Rogue River basin is based on timber, agriculture, offshore commercial fishing, minerals and recreation. There are few local point sources of contaminants.

3. The last evaluation of sediment from the area was completed in 1982 by Corps personnel (2). This evaluation was of sediment from the federally authorized navigation channel. The authorized channel starts offshore, proceeds through the mouth of the Rogue and continues as an access channel ending at the entrance to the boat basin. The results of the evaluation showed that the sediment at the mouth of the Rogue was composed of very coarse sand with some gravel and cobbles. The volatile solids content was less than 2.0 %. Sediment from the boat basin access channel was fine sand or silt with a volatile solids content between 4.0 to 8.0 %. Concentrations of potential contaminants in bulk sediment and elutriates were below established concern levels. There were no known sources of contaminants in the nearby area. The sediment met Clean Water Act and Ocean Dumping Act exclusionary criteria and were considered acceptable for unconfined in-water and upland disposal.

4. The 1982 sediment evaluation did not include samples from within the boat basin proper. To provide background information the USEPA, Region 10 entered into agreement with USACE, Portland District to fund an evaluation of boat basin sediment. In April 1992 Corps personnel obtained 3 samples from the boat basin and 1 from a nearby reference area (see Figure 1).

Methods

5. Samples were taken from aboard the "Melissa" captained by Bill Woods. Four sediment samples were taken from locations shown on the enclosed map. One of the samples (RR-P-2) was a reference sample located about 800 to 1,400 feet east of the boat dock samples in a backwater area outside of the boat basin. All samples were taken with a stainless steel Ponar sampler. Each was subjected to physical and chemical analyses. The physical samples were cold stored in plastic ziplock bags. Physical analyses consisted of determining volatile solids content and grain size distribution. Chemical samples were taken from sediment in the center of the Ponar, not in contact with the sides, using an acid washed stainless steel spoon. The samples were placed in acid washed and hexane rinsed glass jars topped with teflon-lined lids. They were cold stored from time of collection until analysis at the contract analytical lab. Chemical analyses consisted of tests for total organic carbon (TOC), acid volatile sulfides (AVS), metals, organochlorine pesticides, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), and tributyl tins (TBT). All sampling procedures and tests were conducted following EPA/Corps approved methods (3). A quality assurance report of contract lab performance was prepared by the U. S. Army Corps of Engineers North Pacific Division Materials Laboratory, Troutdale, Oregon. It is included as an enclosure with this report.

6. While carrying sampling equipment on board the "Melissa" captain Woods and I observed two workers scraping paint off the sides and hull of the "Tommy Jo", a vessel moored at the eastern boat dock. The paint chips were falling like snow flakes and were clearly visible on the surface of the water in the marina. Later the "Tommy Jo" was observed backing out into the area mid way between the eastern and western boat docks. The vessel moved forwards and backwards in what looked like an attempt to "wash off" the hull. These observations are recorded here in case future sampling efforts uncover contaminants in the sediment associated with paint, such as TBT or metals. No samples were taken from sediment underneath the moorage of the 'Tommy Jo"; nor were paint chips sampled for analysis.

Results/Discussion

7. The raw data from physical and chemical analyses are enclosed. Included are the quality control and quality assurance data.

Physical

8. Results of physical analyses of the sediment samples are shown in Table 1. Locations of samples are shown in Figure 1. Sediment from the center of the eastern docks (RR-P-1) was fine silty sand while material from the centers of the western boat basin docks (RR-P-3,4) was sandy silt. The eastern docks are closer to the sandy shoal that encroaches from the river. The reference area sample (RR-P-2) was more like the samples from the western docks in silt content (65 %) and grain size. The sediment from the western docks had much more silt/clay and contained about twice as much volatile solid as the eastern dock sample. The organic content (volatile solids) of all the samples varied from 4.8 to 11.4 %. The median grain size of all samples ranged from that of medium silt to fine sand.

Chemical

Metals

9. Results of metals analyses are presented in Table 2. For comparison, chemical data from a sample taken in 1982 from a location close to the boat basin are included in the table. Also shown are results of metals analyses of sediment samples taken in 1991, offshore from the mouth of the Rogue River, by the State of Oregon Department of Geology and Mineral Industries (ODGMI) (4).

10. Chromium concentrations (128 to 192 ppm) were some of the highest seen in Oregon coastal estuarine sediments next to those measured in Tillamook Bay at Garibaldi boat basin (21-200 ppm) (5,14). Even the reference sample showed a high chromium level. One sample, RR-P-3, had a chromium concentration (192 ppm) greater than the USEPA, Region 10 screening level (180 ppm) for Puget Sound marine waters.

11. Nickel concentrations were also unusually high compared to samples from other coastal estuaries. This was true for all samples including the reference sample. The nickel concentrations for all samples (186-278 ppm) exceeded the highest recorded concentration found previously, that of a sample from Tillamook Bay near Garibaldi, Oregon (110 ppm) (5). All sample concentrations exceeded the USEPA, Region 10 screening level (140 ppm).

12. Cadmium concentrations (1.0 ppm) in the samples taken from the western boat docks slightly exceeded the EPA screening level (0.96 ppm). No cadmium was detected in the eastern boat dock and reference samples. The same amount of cadmium was found in a sample taken in 1982 at the end of the channel leading into the boat basin. The cadmium concentrations are typical of those found in other coastal marinas.

13. Arsenic, copper, lead, mercury and zinc were below screening levels. The concentrations of arsenic are typical of Oregon coastal marinas. Mercury and lead were undetected. The detection limits for these two metals were slightly elevated. Examination of Table 2 suggests that copper and zinc may be slightly enriched in sediment from the western docks of the boat basin. However, there is no statistical evidence to support this as the number of samples is too small to make comparisons. The sediment from the western docks contained the most silt, clay, TOC and AVS, which are factors that promote enrichment of metals in sediment through physical and chemical processes.

14. The concentrations of metals measured in the one 1982 sample are lower than those measured in this study. The difference between the 1982 and 1992 results is puzzling but is probably related to inter laboratory variation even though the samples were prepared and analyzed in similar ways in both studies. Also, some of the analytical methods have changed since 1982. There is more confidence in the consistent results from 4 samples than those from 1 sample. Thus the 1992 samples probably are the best estimate of concentrations in the sediment.

15. Examination of Table 2 shows that the arsenic, chromium and nickel concentrations are

similar in the offshore samples compared to the boat basin samples and the reference sample. The correlation between offshore and boat basin samples for arsenic concentrations is striking. The boat basin and offshore samples were digested and analyzed using similar methods and this probably accounts for the close correlation. It is interesting to note that the offshore samples are fine sands while the boat basin samples are silts, yet they contain similar concentrations of these metals. This would suggest that the concentrations of these particular metals in the boat basin sediment are not the result of enrichment by anthropogenic sources but are due to the geology of the Rogue River drainage basin. Chromium and nickel have been mined in the Rogue River basin. Rogue River sediments are known to contain chromite and other heavy metal bearing minerals. Elutriate and water quality tests show low concentrations of chromium and nickel (1-5 ppb) dissolved in the water column (2,8). This is to be expected since the elutriate water and Rogue River water were near neutrality and not acidic.

16. In regards to heavy metals in the Gold Beach boat basin it should be noted that there are 5 urban stormwater outfalls that empty into the area between the Highway 101 bridge and the public boat launch (6). These carry runoff from the city of Gold Beach. Urban runoff typically contains heavy metals; especially lead, cadmium, copper and zinc. These outfalls could be a source of metals, PAHs, oil & grease and nutrients, but there is little evidence for enrichment of these in the sediment. More samples need to be taken from reference and boat basin areas to sharpen the picture of conditions there.

AVS

17. AVS concentration was much lower in the sample from the eastern docks than those from the western docks, which were about 6 times greater. AVS concentrations in the boat basin were 800 to 4,600 times greater than that of the reference sample. A major source of the AVS sulfides is the organic material in the sediment. The relatively higher AVS concentrations in the western boat docks area should help to bind heavy metals in metal sulfides. This process reduces the toxicity of heavy metals to aquatic organisms. TOC concentrations for all samples were typical of fine grained sediment.

Pesticides/PCBs

18. Results of analyses for organic contaminants are shown in Table 3. None of the 19 organochlorine pesticides were detected. Detection limits, overall, were slightly higher than EPA and Portland District guidelines. Even so, the detection limits were adequate to detect concentrations of pesticides that could exceed EPA screening levels if they were present. None of the 7 PCB aroclors were detected. Detection limits for PCBs were also slightly elevated. For pesticides and PCBs the elevated detection limits were especially evident in samples RR-P-3 and RR-P-4. This was probably due to the low percent solids in these two samples.

TBT

19. TBT concentrations ranged from 4.4 to 9.6 ppb. The TBT concentration in the reference sample was 6.9 ppb. These levels are on the low end of the range of values measured in sediment from Oregon coastal marinas. For instance, TBT in sediment from five Oregon marinas ranged from 1.4 to 278 ppb (9-13).

Phenols

20. Phenols were detected in only the one sample (RR-P-1) that was taken from the eastern boat basin dock (Table 3). In this sample a mixture of 3- and 4-Methylphenol was found (450 ppb). The analysis could not differentiate the fraction contributed by each of these two phenols. These phenols are constituents of coal tar and creosote. Creosote is used to preserve wood and it is possible the sample contained a piece of treated wood.

PAHs

21. PAHs were detected in 3 out of the 4 samples. The levels are typical of those found in other coastal marinas in Oregon (refs. 9-13). Three to five different PAHs were found in three of the samples. The PAHs detected were phenanthrene (190-1,100 ppb), anthracene (110 ppb), fluoranthene (290-1,300 ppb), pyrene (230-910 ppb) and chrysene (130-400 ppb). Only sample RR-P-1 contained concentrations of phenanthrene, fluoranthene and pyrene that exceeded concern levels. PAHs were not detected in the reference sample that was located about 800 to 1400 feet east of the boat dock samples. Contributing sources of PAHs could be urban run off from the storm drains, combustion products, and local spills of oil and grease. The high organics and fine grained nature of the sediment would serve as a sink for these hydrophobic chemicals.

Conclusions

22. Sediment in the Gold Beach boat basin is sandy, clayey silt. Sediment in the area of the western docks contains more silt, clay, volatile solids, TOC and AVS than the eastern dock sediment, which is closer to the shoal that encroaches from the entrance. Sediment from both docks is high in chromium and nickel, probably of natural origin. Elutriate and water quality tests from other studies show little chromium and nickel dissolved in the water column, and their concentrations are well below EPA water quality criteria (15). Cadmium in the sediment is at a level comparable to other coastal marinas. Copper and zinc may be slightly enriched in the sediment from the western docks but more samples are needed to substantiate this conclusion. Arsenic, mercury and lead concentrations are below concern levels. Pesticides and PCBs were undetected. Phenols were detected in only one sample. This same sample contained levels of the PAHs phenanthrene, fluoranthene and pyrene that exceed EPA concern levels. TBT concentrations are low and similar to those of other coastal marinas. In general, the level of contaminants in the sediment is typical of those from other uncontaminated coastal marinas in Oregon. The unusual feature of Gold Beach boat basin sediment is the relatively high chromium and nickel concentrations.

Recommendations

23. Future studies should include reference sediment samples from another quiescent area that has similar grain size, volatile solids and TOC content but perhaps from an area outside of the jetty and further away from possible urban stormwater outfalls. Chemical analyses of these samples should show more clearly if there is metals enrichment in the boat basin sediment. For

proper statistical comparison at least 5 references samples and 5 boat basin samples should be collected and analyzed assuming funding is available.

24. Also, at some point bioassays should be conducted to determine if the chromium and nickel found in the sediment is bioavailable. It is probable that the sediment in-place is not toxic for the following reasons. The levels of chromium and nickel found are within normal background for the coast of Oregon, and the geology of the Rogue River basin. Elutriate and water quality data show that the chromium and nickel are firmly bound to the sediment grains. Thus, toxicity to water column organisms is unlikely. However, to be certain of these predictions solid and liquid phase bioassays should be performed. Further, if dredged material is placed upland and then allowed to dry, mobilization of chromium and nickel, as well as other metals, may result from oxidation of the sediment. Surface water and leachate water coming from dried, then re-watered sediment may contain elevated levels of these two metals especially. Tests of dried sediment for metals mobilization may be necessary in order to ascertain the least environmentally damaging disposal method.

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Table 1. Results of physical analyses of Gold Beach boat basin sediment.

sample	med. gr. size mm	gravel	sand	silt	clay	volatile solids
				%		
RR-P-1	0.130	0.0	67.2	27.1	5.7	4.8
RR-P-2*	0.036	0.0	26.5	65.2	8.3	5.0
RR-P-3	0.018	0.0	9.0	77.5	13.5	9.5
RR-P-4	0.013	0.0	5.7	81.4	12.9	11.4

* Reference sample

Table 2. Concentrations of metals, AVS and TOC in Gold Beach boat basin sediment.

sample	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	AVS	TC
					(ppm)				(uM/g)	(%
1992										
RR-P-1	4	<1	128	26	<20	<0.2	187	56	25.00	1.7
RR-P-2*	4	<1	163	31	<20	<0.2	275	70	0.03	0.5
RR-P-3	5	1	192	59	<20	<0.2	278	104	140.00	3.2
RR-P-4	4	1	138	45	<20	<0.2	186	80	140.00	3.1
1982										
Site 3	6	<1.0	20	20	10	0.1	-	13	-	
ODGMI~										
2F	4.6	0.5	170	15	-	-	170	50	-	0.15
3B	5.2	-	170	10	-	-	150	49	-	0.18
4B	4.4	-	340	14	-	-	170	60	-	0.16
5A	5.2	-	170	14	-	-	160	50	-	0.15
Screening level	57	0.96	180	81	66	0.21	140	160	-	

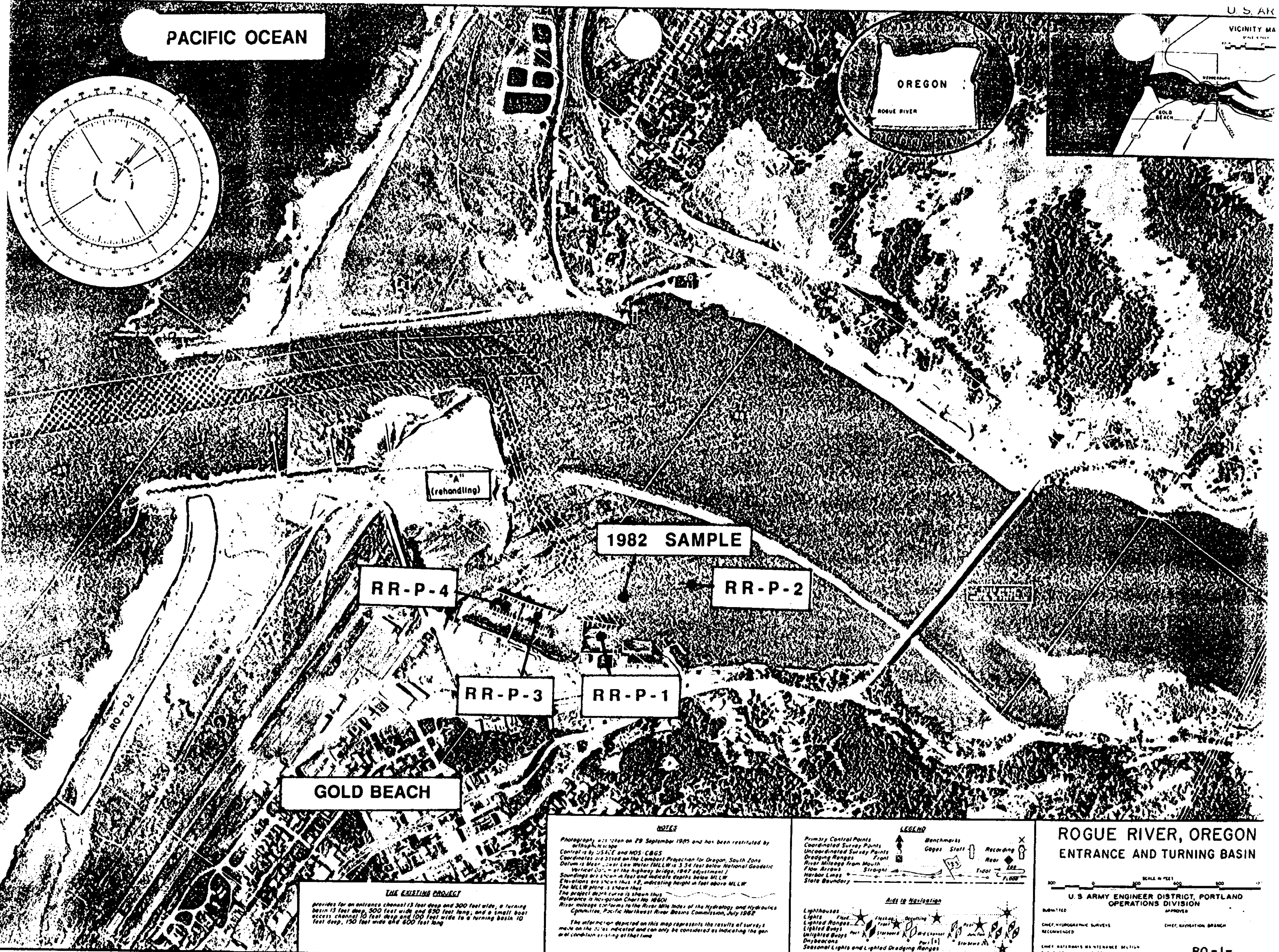
* Reference sample
~ Oregon Department of Geology and Mineral Industries, offshore samples
^ wet weight basis
- Not measured

Table 3. Concentrations of organic contaminants in Gold Beach boat basin sediment.

sample	phenan-threne	anthra-cene	fluoran-thene	pyrene	chrysene	phenols~	TBT	pesticides	PCBs
					(ppb)				
RR-P-1	1,100	-	1,300	910	400	450	4.4	ND	ND
RR-P-2*	ND	ND	ND	ND	ND	ND	6.9	ND	ND
RR-P-3	190	ND	290	230	ND	ND	9.6	ND	ND
RR-P-4	260	110	410	340	130	ND	-	ND	ND
Screening level	320	130	630	430	670	-	30.0	-	130

~ 3 and 4 methylphenols

* Reference sample


U.S. AR
VICINITY MA
PACIFIC OCEAN
OREGON
ROGUE RIVER
GOLD BEACH
"A" (rehandling)
1982 SAMPLE
RR-P-4
RR-P-2
RR-P-3
RR-P-1
RO-0.2
GOLD BEACH
THE EXISTING PROJECT
provides for an entrance channel 13 feet deep and 300 feet wide; a turning basin 13 feet deep, 500 feet wide and 850 feet long; and a small boat access channel 10 feet deep and 100 feet wide to a turning basin 10 feet deep, 150 feet wide and 600 feet long
NOTES
Control is by USACE and NOS-CBGS
Coordinates are based on the Lambert Projection for Oregon, South Zone
Soundings are shown in feet and indicate depths below MLLW
Reference is Navigation Chart No 18601
River mileage conforms to the River Mile Index of the Hydrology and Hydraulics Committee, Pacific Northwest River Basins Commission, July 1962
LEGEND
Primary Control Points
Coordinated Survey Points
Uncoordinated Survey Points
Dredging Ranges Front Rear
River Mileage from Mouth
Flow Arrows Straight Tidal
Harbor Lines
State Boundary
Benchmarks
Gages Staff Recording
Aids to Navigation
Lighthouses
Lights
Lighted Ranges
Lighted Buoys
Unlighted Buoys
Daybeacons
Seasonal Lights and Lighted Dredging Ranges
ROGUE RIVER, OREGON
ENTRANCE AND TURNING BASIN
SCALE IN FEET
U.S ARMY ENGINEER DISTRICT, PORTLAND
OPERATIONS DIVISION
SUBMITTED
APPROVED
RECOMMENDED
SURVEYED
CHECKED
RO-1-

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION LABORATORY
CORPS OF ENGINEERS
1491 N.W. GRAHAM AVENUE
TROUTDALE, OREGON 97060-9503

CENPD-PE-GT-L (1110-1-8100c) 14 Jul 92

MEMORANDUM FOR: Commander, Portland District, ATTN: CENPP-PE-HR (Britton)

SUBJECT: W.O. 92-SHM-181, Results of Chemical Analyses

Project: ROGUE RIVER
Intended Use: Evaluate site
Source of Material: Reference Chain of Custody Records
Submitted by: CENPP-PE-HR (Britton)
Date Sampled: 28 Apr 92 Date Received: 30 Apr 92
Methods of Test: Reference Enclosure 1
Reference: DD Form 448, MIPR No. E86-92-0072, dated 4 Mar 92

1. Enclosed are results of analyses and quality assurance data for environmental samples collected from the above site. Included are report number K922775 from Columbia Analytical Services, Inc., Chain of Custody and Cooler Receipt forms.

2. All method blanks were free of targeted analytes. All matrix spike, matrix spike duplicates and surrogate recoveries were within quality control limits. All samples were extracted six days after recommended holding times for polynuclear aromatics (PNA) and phenol analyses. All other holding times were met. Detection limits were elevated in all pesticide/PCB, PNA and phenol samples, due to low percent solids in samples as-received. All other detection limits met method requirements. All data are acceptable.

3. If you have any questions or comments please contact Dr. Ajmal Ilias at (503) 665-4166.

4. This completes all work requested for these samples.

Timothy J. Seeman

Enclosures

TIMOTHY J. SEEMAN
Director

Copy Furnished: CENPD-PE-GT

RM 0.19

* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

ROGUE RIVER (92-SHM-181)

Boring: -- Sample: RR-P-1 Depth: -- Lab No.: 18115

----- Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	457.20	0.0
No. 18	0.00	100.0
No. 35	0.27	99.7
No. 60	1.30	98.4
No. 120	44.67	44.9
No. 230	54.43	32.8
Pan	81.00	0.0

$\bar{x} = 0.118$

---------- Hydrometer Analysis ----------

Sample Weight: 81. gr. Start Time: 0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	24.2	0.0471	30.2
3	20.0	18.7	0.0281	23.5
10	20.0	13.2	0.0159	16.7
100	20.0	6.7	0.0067	8.8
200	20.0	4.2	0.0048	5.7

D85: 0.21 D60: 0.15 D50: 0.13 D30: .046 D15: .013 D10: .0078 mm

Cu: 19.4 Cc: 1.83

Liquid Limit: NP Plasticity Index: NP

Fines Type Used for Classification: ML, SILT

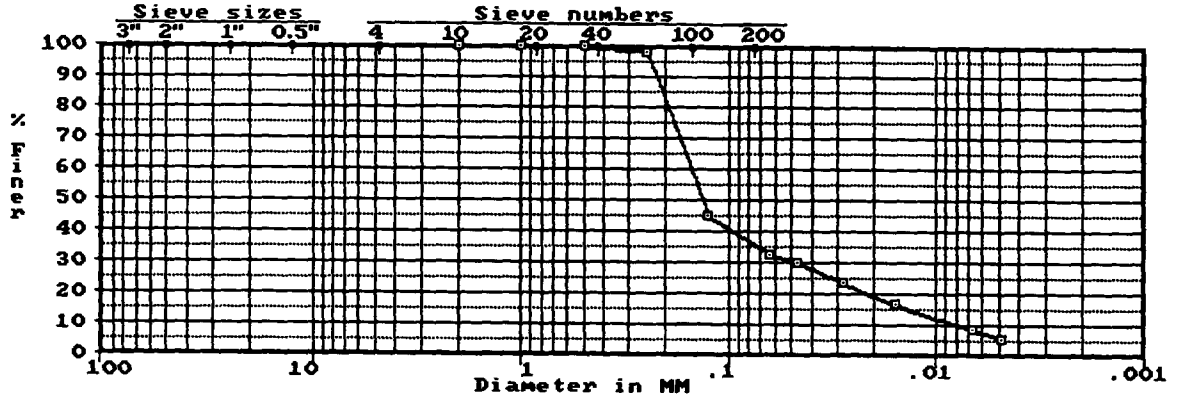
Gravel: 0.0% Sand: 64.1% Fines: 35.9%

---------- ASTM D 2487 Classification ----------

SM Silty SAND

---------- Comments ----------

- VOLATILE SOLIDS = 4.8%



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

ROGUE RIVER (92-SHM-181)

Boring: -- Sample: RR-P-2 Depth: -- Lab No.: 18116

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	398.50	0.0
No. 18	0.11	99.9
No. 35	2.08	97.2
No. 60	5.26	92.9
No. 120	5.47	92.6
No. 230	19.52	73.5
Pan	73.70	0.0

$\bar{X} = 0.045$

---------- Hydrometer Analysis ----------

Sample Weight: 73.7 gr. Start Time: 0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	41.7	0.0412	56.7
3	20.0	26.7	0.0267	36.5
10	20.0	16.2	0.0157	22.4
100	20.0	8.2	0.0067	11.7
200	20.0	5.7	0.0048	8.3

D85: .089 D60: .045 D50: .036 D30: .022 D15: .0094 D10: .0057 mm

Cu: 7.82 Cc: 1.86

Liquid Limit: NP Plasticity Index: NP

Fines Type Used for Classification: ML, SILT

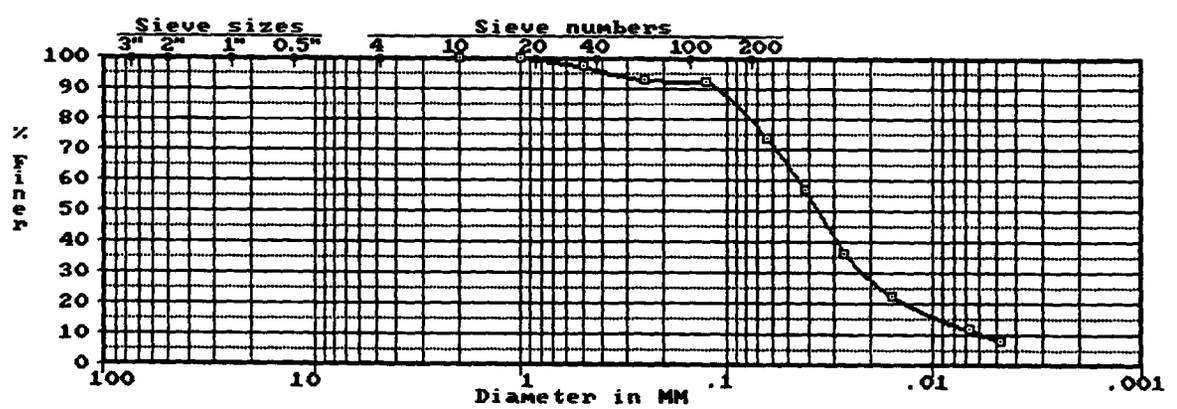
Gravel: 0.0% Sand: 20.3% Fines: 79.7%

---------- ASTM D 2487 Classification ----------

ML SILT with sand

---------- Comments ----------

- VOLATILE SOLIDS = 5.0%



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ROGUE RIVER (92-SHM-181)

Boring: -- Sample: RR-P-3 Depth: -- Lab No.: 18117

----- Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	183.50	0.0
No. 18	0.00	100.0
No. 35	0.04	99.9
No. 60	0.23	99.5
No. 120	0.31	99.3
No. 230	4.08	91.0
Pan	45.50	0.0

---------- Hydrometer Analysis ----------

Sample Weight:45.5 gr. Start Time:0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	36.2	0.0431	79.9
3	20.0	28.7	0.0263	63.5
10	20.0	19.7	0.0153	44.0
100	20.0	9.2	0.0067	21.1
200	20.0	5.7	0.0048	13.5

$\bar{r} = 0.025$

D85: .051 D60: .024 D50: .018 D30: .0095 D15: .0051 mm

Liquid Limit: NP Plasticity Index: NP

Fines Type Used for Classification: ML, SILT

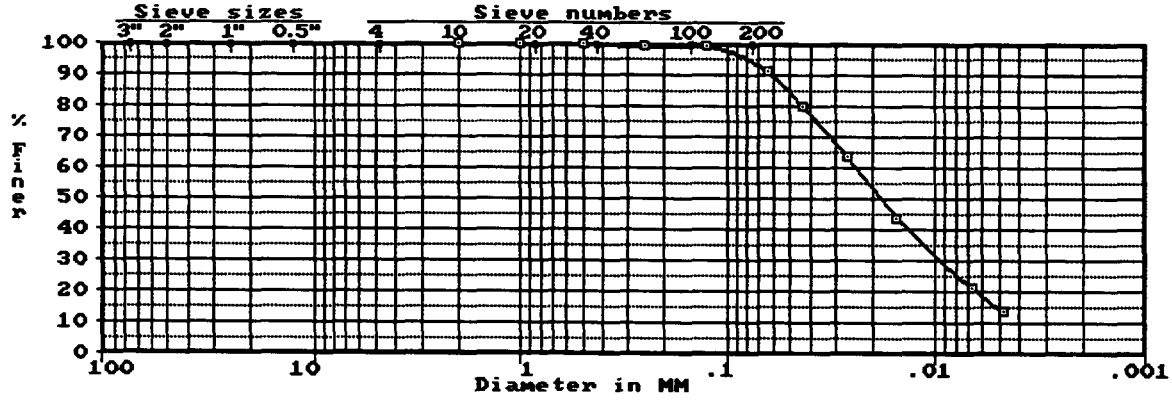
Gravel: 0.0% Sand: 5.8% Fines: 94.2%

---------- ASTM D 2487 Classification ----------

ML SILT

---------- Comments ----------

- VOLATILE SOLIDS = 9.5%



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

ROGUE RIVER (92-SHM-181)

Boring: -- Sample: RR-P-4 Depth: -- Lab No.: 18118

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	307.20	0.0
No. 18	0.00	100.0
No. 35	0.04	99.9
No. 60	0.25	99.6
No. 120	0.98	98.6
No. 230	3.90	94.3
Pan	69.00	0.0

---------- Hydrometer Analysis ----------

Sample Weight:69. gr. Start Time:0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	58.7	0.0346	84.9
3	20.0	48.7	0.0223	70.6
10	20.0	35.7	0.0137	51.9
100	20.0	12.2	0.0065	18.2
200	20.0	8.5	0.0047	12.9

$\bar{X} = 0.018$

D85: .035 D60: .017 D50: .013 D30: .0087 D15: .0056 mm

Liquid Limit: NP Plasticity Index: NP

Fines Type Used for Classification: ML, SILT

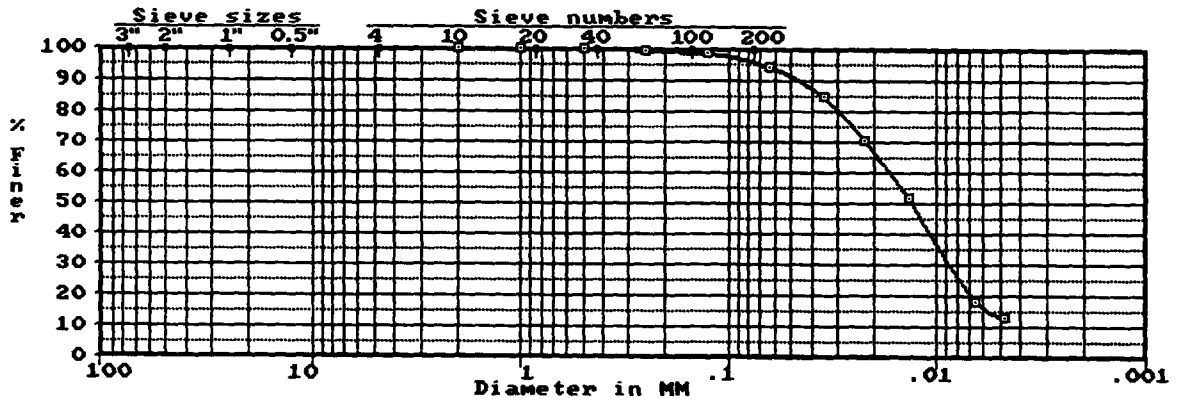
Gravel: 0.0% Sand: 4.1% Fines: 95.9%

---------- ASTM D 2487 Classification ----------

ML SILT

---------- Comments ----------

- VOLATILE SOLIDS = 11.4%



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

ROGUE RIVER (92-SHM-181)

Boring: -- Sample: **RR-P-5** Depth: -- Lab No.: 18119

----- Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	215.10	92.0
5/8 In.	357.60	86.6
5/16 In.	388.10	85.5
No. 5	409.80	84.7
No. 10	445.00	83.4
Pan	2673.80	0.0
No. 18	6.45	80.4
No. 35	40.24	65.0
No. 60	104.13	35.9
No. 120	162.63	9.3
No. 230	183.00	0.0
Pan	183.03	0.0

No hydrometer analysis.

$\bar{x} = 1.877$

D85: 5.14 D60: 0.44 D50: 0.34 D30: 0.22 D15: 0.15 D10: 0.13 mm

Cu: 3.44 Cc: 0.85

Liquid Limit: NP Plasticity Index: NP

Fines Type Used for Classification: ML, SILT

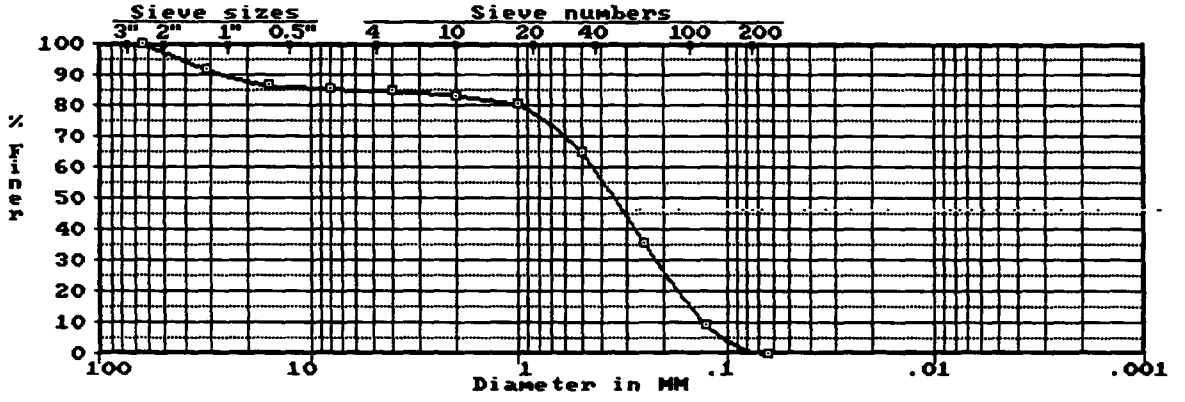
Gravel: 15.1% Sand: 84.1% Fines: 0.8%

---------- ASTM D 2487 Classification ----------

SP Poorly graded SAND with gravel

---------- Comments ----------

- VOLATILE SOLIDS = 2.6%



Columbia Analytical Services inc.

June 1, 1992

Tim Seeman
U.S. Army Corps of Engineers
CENPD Materials Laboratory
1491 NW Graham Avenue
Troutdale, OR 97060-9503

Re: **Rogue River/Project #92-SHM-181**

Dear Tim:

Enclosed are the results of the samples submitted to our lab on April 30, 1992. For your reference, these analyses have been assigned our work order number K922775.

All analyses were performed in accordance with our laboratory's quality assurance program.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Kevin DeWhitt
Project Chemist

KD/so

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/03/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Solids, Total
Volatile Organic Compounds
EPA Method Modified 160.3
Percent (%)

Sample Name	Lab Code	Result
RR-P-1	K2775-1	56.8
RR-P-2	K2775-2	59.6
RR-P-3	K2775-3	35.4
RR-P-4	K2775-4	32.8

Approved by [signature] 21 Date 6-1

00001

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/20/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Total Organic Carbon (TOC)
EPA Method Modified 415.1
Percent (%)
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
RR-P-1	K2775-1	0.05	1.76
RR-P-2	K2775-2	0.05	0.53
RR-P-3	K2775-3	0.05	3.23
RR-P-4	K2775-4	0.05	3.13
Method Blank	K2775-MB	0.05	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by _____ Date 6-1

00002

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/12/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Acid Volatile Sulfides
EPA Draft Method for Acid Volatile Sulfide in Sediment - August 1991
μmoles/g
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
RR-P-1	K2775-1	0.01	25
RR-P-2	K2775-2	0.01	0.03
RR-P-3	K2775-3	0.01	140
RR-P-4	K2775-4	0.01	140
Method Blank	K2775-MB	0.01	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by [signature] 23 Date 6-1

00003

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Work Order No.:**	K922775
Sample Matrix:	Sediment		

Total Metals
mg/Kg (ppm)
Dry Weight Basis

	Sample Name:		RR-P-1	RR-P-2	RR-P-3
	Lab Code:		K2775-1	K2775-2	K2775-3
Analyte	**EPA Method**	**MRL**			
Arsenic	7060	1	4	4	5
Cadmium	6010	1	ND	ND	1
Chromium	6010	2	128	163	192
Copper	6010	2	26	31	59
Lead	6010	20	ND	ND	ND
Mercury	7471	0.2	ND	ND	ND
Nickel	6010	10	187	275	278
Zinc	6010	2	56	70	104

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by [signature] 24 Date 6-1

00004

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Work Order No.:**	K922775
Sample Matrix:	Sediment		

Total Metals
mg/Kg (ppm)
Dry Weight Basis

	Sample Name:		RR-P-4	Method Blank
	Lab Code:		K2775-4	K2775-MB
Analyte	**EPA Method**	**MRL**		
Arsenic	7060	1	4	ND
Cadmium	6010	1	1	ND
Chromium	6010	2	138	ND
Copper	6010	2	45	ND
Lead	6010	20	ND	ND
Mercury	7471	0.2	ND	ND
Nickel	6010	10	186	ND
Zinc	6010	2	80	ND

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by [signature] 25 Date 5-1

00005

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/02/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)
EPA Methods 3540/8080
mg/Kg (ppm)
Dry Weight Basis

Sample Name:		**RR-P-1**	**RR-P-2**	**RR-P-3**
Lab Code:		**K2775-1**	**K2775-2**	**K2775-3**
Date Analyzed:		**05/06/92**	**05/06/92**	**05/06/92**
Analyte	**MRL**			
Alpha-BHC	0.01	ND	ND	*<0.02
Gamma-BHC (Lindane)	0.01	ND	ND	*<0.02
Beta-BHC	0.03	ND	ND	*<0.06
Heptachlor	0.01	ND	ND	*<0.02
Delta-BHC	0.01	ND	ND	*<0.02
Aldrin	0.01	ND	ND	*<0.02
Heptachlor Epoxide	0.01	ND	ND	*<0.02
Endosulfan I	0.01	ND	ND	*<0.02
4,4'-DDE	0.01	ND	ND	*<0.02
Dieldrin	0.01	ND	ND	*<0.02
Endrin	0.01	ND	ND	*<0.02
4,4'-DDD	0.01	ND	ND	*<0.02
Endosulfan II	0.01	ND	ND	*<0.02
4,4'-DDT	0.01	ND	ND	*<0.02
Endrin Aldehyde	0.01	ND	ND	*<0.02
Endosulfan Sulfate	0.01	ND	ND	*<0.02
Methoxychlor	0.02	ND	ND	*<0.04
Toxaphene	0.3	ND	ND	*<0.6
Chlordane	0.1	ND	ND	*<0.2
PCBs: Aroclor 1016	0.1	ND	ND	*<0.2
Aroclor 1221	0.1	ND	ND	*<0.2
Aroclor 1232	0.1	ND	ND	*<0.2
Aroclor 1242	0.1	ND	ND	*<0.2
Aroclor 1248	0.1	ND	ND	*<0.2
Aroclor 1254	0.1	ND	ND	*<0.2
Aroclor 1260	0.1	ND	ND	*<0.2

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
* MRL is elevated because of the low percent solids in the sample as received.

Approved by Kevin Devlin 26 Date 6-1

U0006

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/02/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)
EPA Methods 3540/8080
mg/Kg (ppm)
Dry Weight Basis

		RR-P-4	Method Blank
Sample Name:			
Lab Code:		K2775-4	K2775-MB
Date Analyzed:		05/06/92	05/06/92
Analyte	**MRL**		
Alpha-BHC	0.01	*<0.02	ND
Gamma-BHC (Lindane)	0.01	*<0.02	ND
Beta-BHC	0.03	*<0.06	ND
Heptachlor	0.01	*<0.02	ND
Delta-BHC	0.01	*<0.02	ND
Aldrin	0.01	*<0.02	ND
Heptachlor Epoxide	0.01	*<0.02	ND
Endosulfan I	0.01	*<0.02	ND
4,4'-DDE	0.01	*<0.02	ND
Dieldrin	0.01	*<0.02	ND
Endrin	0.01	*<0.02	ND
4,4'-DDD	0.01	*<0.02	ND
Endosulfan II	0.01	*<0.02	ND
4,4'-DDT	0.01	*<0.02	ND
Endrin Aldehyde	0.01	*<0.02	ND
Endosulfan Sulfate	0.01	*<0.02	ND
Methoxychlor	0.02	*<0.04	ND
Toxaphene	0.3	*<0.3	ND
Chlordane	0.1	*<0.2	ND
PCBs: Aroclor 1016	0.1	*<0.2	ND
Aroclor 1221	0.1	*<0.2	ND
Aroclor 1232	0.1	*<0.2	ND
Aroclor 1242	0.1	*<0.2	ND
Aroclor 1248	0.1	*<0.2	ND
Aroclor 1254	0.1	*<0.2	ND
Aroclor 1260	0.1	*<0.2	ND

MRL Method Reporting Limit
***** MRL is elevated because of the low percent solids in the sample as received.
ND None Detected at or above the method reporting limit

Approved by _____ Date 6-1

U0007

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/19/92
		Work Order No.:	K922775

Polynuclear Aromatic Hydrocarbons
EPA Method 3550 in combination with GC/MS SIM Method
μg/Kg (ppb)
Dry Weight Basis

Sample Name:		**RR-P-1***
Lab Code:		**K2775-1**
Analyte	**MRL****	
Naphthalene	280	ND
2-Methylnaphthalene	280	ND
Acenaphthylene	280	ND
Dibenzofuran	280	ND
Acenaphthene	280	ND
Fluorene	280	ND
Phenanthrene	280	1,100
Anthracene	280	ND
Fluoranthene	280	1,300
Pyrene	280	910
Benz(a)anthracene	280	ND
Chrysene	280	400
Benzo(b+k)fluoranthene♦	570	ND
Benzo(a)pyrene	280	ND
Indeno(1,2,3-cd)pyrene	280	ND
Dibenz(a,h)anthracene	280	ND
Benzo(g,h,i)perylene	280	ND

SIM Selected Ion Monitoring

* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.

MRL Method Reporting Limit

** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.

ND None Detected at or above the method reporting limit

♦ These compounds coelute; therefore, the results are reported as the combined concentration.

Approved by [signature] 28 Date 6-1

00008

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Polynuclear Aromatic Hydrocarbons
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		RR-P-2*
Lab Code:		K2775-2
Analyte	**MRL****	
Naphthalene	52	ND
2-Methylnaphthalene	52	ND
Acenaphthylene	52	ND
Dibenzofuran	52	ND
Acenaphthene	52	ND
Fluorene	52	ND
Phenanthrene	52	ND
Anthracene	52	ND
Fluoranthene	52	ND
Pyrene	52	ND
Benz(a)anthracene	52	ND
Chrysene	52	ND
Benzo(b + k)fluoranthene♦	100	ND
Benzo(a)pyrene	52	ND
Indeno(1,2,3-cd)pyrene	52	ND
Dibenz(a,h)anthracene	52	ND
Benzo(g,h,i)perylene	52	ND

SIM Selected Ion Monitoring

* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.

MRL Method Reporting Limit

** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.

ND None Detected at or above the method reporting limit

♦ These compounds coelute; therefore, the results are reported as the combined concentration.

Approved by [signature] 29 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Polynuclear Aromatic Hydrocarbons
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:	RR-P-3*
Lab Code:	K2775-3

Analyte	MRL**	
Naphthalene	93	ND
2-Methylnaphthalene	93	ND
Acenaphthylene	93	ND
Dibenzofuran	93	ND
Acenaphthene	93	ND
Fluorene	93	ND
Phenanthrene	93	190
Anthracene	93	ND
Fluoranthene	93	290
Pyrene	93	230
Benz(a)anthracene	93	ND
Chrysene	93	ND
Benzo(b+k)fluoranthene♦	190	ND
Benzo(a)pyrene	93	ND
Indeno(1,2,3-cd)pyrene	93	ND
Dibenz(a,h)anthracene	93	ND
Benzo(g,h,i)perylene	93	ND

Total 710

SIM Selected Ion Monitoring
* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.
MRL Method Reporting Limit
** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.
ND None Detected at or above the method reporting limit
♦ These compounds coelute; therefore, the results are reported as the combined concentration.

Approved by [signature] 30 Date 6-1

00010

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Polynuclear Aromatic Hydrocarbons
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		**RR-P-4***
Lab Code:		**K2775-4**
Analyte	**MRL****	
Naphthalene	96	ND
2-Methylnaphthalene	96	ND
Acenaphthylene	96	ND
Dibenzofuran	96	ND
Acenaphthene	96	ND
Fluorene	96	ND
Phenanthrene	96	260
Anthracene	96	110
Fluoranthene	96	410
Pyrene	96	340
Benz(a)anthracene	96	ND
Chrysene	96	130
Benzo(b + k)fluoranthene♦	190	ND
Benzo(a)pyrene	96	ND
Indeno(1,2,3-cd)pyrene	96	ND
Dibenz(a,h)anthracene	96	ND
Benzo(g,h,i)perylene	96	ND
		Total 1,250

SIM Selected Ion Monitoring

* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.

MRL Method Reporting Limit

** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.

ND None Detected at or above the method reporting limit

♦ These compounds coelute; therefore, the results are reported as the combined concentration.

Approved by Kevin Devlin Date 6-1

00011

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Extracted:**	05/17/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/18/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Polynuclear Aromatic Hydrocarbons
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		Method Blank
Lab Code:		K2775-MB
Analyte	**MRL**	
Naphthalene	20	ND
2-Methylnaphthalene	20	ND
Acenaphthylene	20	ND
Dibenzofuran	20	ND
Acenaphthene	20	ND
Fluorene	20	ND
Phenanthrene	20	ND
Anthracene	20	ND
Fluoranthene	20	ND
Pyrene	20	ND
Benz(a)anthracene	20	ND
Chrysene	20	ND
Benzo(b + k)fluoranthene♦	40	ND
Benzo(a)pyrene	20	ND
Indeno(1,2,3-cd)pyrene	20	ND
Dibenz(a,h)anthracene	20	ND
Benzo(g,h,i)perylene	20	ND

SIM Selected Ion Monitoring
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
♦ These compounds coelute; therefore, the results are reported as the combined concentration.

Approved by [signature] 32 Date 6-1

00012

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	Date Received:	04/30/92
Project:	Rogue River/#92-SHM-181	Date Extracted:	05/17/92
Sample Matrix:	Sediment	Date Analyzed:	05/19/92
		Work Order No.:	K922775

Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		RR-P-1*
Lab Code:		K2775-1
Analyte	**MRL****	
Phenol	280	ND
2-Methylphenol	280	ND
3- and 4-Methylphenol♦	280	450
2,4-Dimethylphenol	280	ND
Pentachlorophenol	710	ND

SIM Selected Ion Monitoring
* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.
MRL Method Reporting Limit
** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.
ND None Detected at or above the method reporting limit
♦ Quantified as 4-methylphenol.

Approved by _____ Date 6-1

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		RR-P-2*
Lab Code:		K2775-2
Analyte	**MRL****	
Phenol	52	ND
2-Methylphenol	52	ND
3- and 4-Methylphenol♦	52	ND
2,4-Dimethylphenol	52	ND
Pentachlorophenol	130	ND

SIM Selected Ion Monitoring
***** Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.
MRL Method Reporting Limit
****** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.
ND None Detected at or above the method reporting limit
♦ Quantified as 4-methylphenol.

Approved by [signature] 34 Date 6-1

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		**RR-P-3***
Lab Code:		**K2775-3**
Analyte	**MRL****	
Phenol	93	ND
2-Methylphenol	93	ND
3- and 4-Methylphenol♦	93	ND
2,4-Dimethylphenol	93	ND
Pentachlorophenol	240	ND

SIM Selected Ion Monitoring
* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.
MRL Method Reporting Limit
** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.
ND None Detected at or above the method reporting limit
♦ Quantified as 4-methylphenol.

Approved by [signature] 35 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		RR-P-4*
Lab Code:		K2775-4
Analyte	**MRL****	
Phenol	96	ND
2-Methylphenol	96	ND
3- and 4-Methylphenol♦	96	ND
2,4-Dimethylphenol	96	ND
Pentachlorophenol	240	ND

SIM Selected Ion Monitoring

* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.

MRL Method Reporting Limit

** MRLs are elevated because of matrix interferences and because the sample(s) required diluting.

ND None Detected at or above the method reporting limit

♦ Quantified as 4-methylphenol.

Approved by [signature] 36 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	U.S. Army Corps of Engineers	**Date Extracted:**	05/17/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/18/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name:		**Method Blank**
Lab Code:		**K2775-MB**
Analyte	**MRL**	
Phenol	20	ND
2-Methylphenol	20	ND
3- and 4-Methylphenol♦	20	ND
2,4-Dimethylphenol	20	ND
Pentachlorophenol	50	ND

SIM Selected Ion Monitoring
MRL Method Reporting Limit
ND None Detected at or above the method reporting limit
♦ Quantified as 4-methylphenol.

Approved by _____ Date 6-1

APPENDIX A

LABORATORY QC RESULTS

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/20/92
Sample Matrix:	Sediment	**Work Order No.:**	K922775

Duplicate Summary
Total Organic Carbon (TOC)
EPA Method Modified 415.1
Percent (%)
Dry Weight Basis

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
RR-P-1	K2775-1	0.05	1.76	1.77	1.76	<1

MRL Method Reporting Limit

Approved by KENNE TENNANT Date 6-1

00019

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Distilled:**	05/12/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/12/92
		Work Order No.:	K922775

Duplicate Summary
Acid Volatile Sulfides
EPA Draft Method for Acid Volatile Sulfide in Sediment - August 1991
µmoles/g
Dry Weight Basis

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
RR-P-1	K2775-1	0.01	25	26	26	4

MRL Method Reporting Limit

Approved by [signature] 41 Date 6-1

00020

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Distilled:**	05/12/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/12/92
		Work Order No.:	K922775

Matrix Spike/Duplicate Matrix Spike Summary
Acid Volatile Sulfides
EPA Draft Method for Acid Volatile Sulfide in Sediment - August 1991
µmoles/g
Dry Weight Basis

Sample Name: RR-P-1

Lab Code	Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria	Relative Percent Difference
K2775-1MS	AVS	0.1	4.0	25	23	NA	NA	
K2775-1DMS	AVS	0.1	4.0	25	27	NA	NA	16

MRL Method Reporting Limit
NA Not Applicable because of the sample matrix. Accuracy of the spike recovery value is reduced, since the sample concentration was greater than five times the amount spiked.

Approved by KEVIN DENNETT 42 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Work Order No.:**	K922775
Sample Matrix:	Sediment		

Duplicate Summary
Total Metals
mg/Kg (ppm)
Dry Weight Basis

Sample Name: RR-P-1
Lab Code: K2775-1

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Arsenic	7060	1	4	4	4	<1
Cadmium	6010	1	ND	1	--	--
Chromium	6010	2	128	132	130	3
Copper	6010	2	26	28	27	7
Lead	6010	20	ND	ND	ND	--
Mercury	7471	0.2	ND	ND	ND	--
Nickel	6010	10	187	187	187	<1
Zinc	6010	2	56	58	57	4

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by [signature] 43 Date 6-1

00022

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Work Order No.:**	K922775
Sample Matrix:	Sediment		

Matrix Spike Summary
Total Metals
mg/Kg (ppm)
Dry Weight Basis

Sample Name: RR-P-1
Lab Code: K2775-1

Analyte	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Arsenic	1	14	4	16	86	60-130
Cadmium	1	18	ND	16	89	60-130
Chromium	2	70	128	208	114	60-130
Copper	2	88	26	102	86	60-130
Lead	20	176	ND	155	88	60-130
Mercury	0.2	0.4	ND	0.5	125	60-130
Nickel	10	176	187	350	93	60-130
Zinc	2	176	56	200	82	60-130

MRL Method Reporting Limit
ND None Detected at or above the method reporting limit

Approved by [signature] 44 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/02/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/06/92
		Work Order No.:	K922775

Surrogate Recovery Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)
EPA Methods 3540/8080

Sample Name	Lab Code	Percent Recovery	
		Tetrachloro-*m*-xylene	Decachlorobiphenyl
RR-P-1	K2775-1	75	74
RR-P-2	K2775-2	50	66
RR-P-2	K2775-2MS	75	74
RR-P-2	K2775-2DMS	68	67
RR-P-3	K2775-3	71	82
RR-P-4	K2775-4	68	72
Laboratory Control Sample	K2775-LCS	62	72
Method Blank	K2775-MB	58	69
	CAS Acceptance Criteria	45-112	53-120

Approved by [signature] 45 Date 6-1

00024

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/02/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/06/92
		Work Order No.:	K922775

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)
EPA Methods 3540/8080
mg/Kg (ppm)
Dry Weight Basis

Sample Name: RR-P-2
Lab Code: K2775-2

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	Result	MS	DMS	MS	DMS	Criteria	Difference
Gamma-BHC (Lindane)	0.11	0.11	ND	0.08	0.07	73	64	52-125	13
Heptachlor	0.11	0.11	ND	0.09	0.08	82	73	38-147	12
Aldrin	0.11	0.11	ND	0.10	0.09	91	82	51-124	10
Dieldrin	0.11	0.11	ND	0.11	0.10	100	91	57-130	9
Endrin	0.11	0.11	ND	0.12	0.10	109	91	54-143	18
4,4'-DDT	0.11	0.11	ND	NA	NA	NA	NA	40-157	--

ND None Detected at or above the method reporting limit
NA Not Applicable because of the sample matrix. The chromatogram showed nontarget components that interfered with the analysis.

Approved by _____ 46 Date 6-7

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Extracted:**	05/02/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/06/92
LCS Matrix:	Soil	**Work Order No.:**	K922775

Laboratory Control Sample Summary
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)
EPA Methods 3540/8080
mg/Kg (ppm)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Gamma-BHC (Lindane)	0.07	0.04	57	52-125
Heptachlor	0.07	0.05	71	38-147
Aldrin	0.07	0.05	71	51-124
Dieldrin	0.07	0.05	71	57-130
Endrin	0.07	0.05	71	54-143
4,4'-DDT	0.07	0.04	57	40-157

Approved by [signature] Date 6-1

00026

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Surrogate Recovery Summary
Phthalate Esters and Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550 in combination with GC/MS SIM Method

Sample Name	Lab Code	Percent Recovery					
		NAP	FLR	CRY	2FP	PHL	TBP
RR-P-1	K2775-1MS	NA	NA	NA	NA	NA	NA
RR-P-1	K2775-1DMS	NA	NA	NA	NA	NA	NA
RR-P-2	K2775-2	NA	NA	NA	NA	NA	NA
RR-P-3	K2775-3	NA	NA	NA	NA	NA	NA
RR-P-4	K2775-4	NA	NA	NA	NA	NA	NA
Method Blank	K2775-MB	78	92	101	62	77	43
Laboratory Control Sample	K2775-LCS	69	83	111	55	66	52

SIM Selected Ion Monitoring
NAP Naphthalene-D_8
FLR Fluorene-D_{10}
CRY Chrysene-D_{12}
2FP 2-Fluorophenol
PHL Phenol-D_6
TBP 2,4,6-Tribromophenol

NA Not Applicable because of the sample matrix. Analysis of this sample required a dilution such that the surrogate concentration was diluted below the MRL.

Approved by [signature] 48 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/19/92
		Work Order No.:	K922775

Surrogate Recovery Summary
Phthalate Esters and Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550 in combination with GC/MS SIM Method

Sample Name	Lab Code	Percent Recovery					
		NAP	FLR	CRY	2FP	PHL	TBP
RR-P-1	K2775-1	NA	NA	NA	NA	NA	NA

SIM Selected Ion Monitoring
NAP Naphthalene-D_8
FLR Fluorene-D_{10}
CRY Chrysene-D_{12}
2FP 2-Fluorophenol
PHL Phenol-D_6
TBP 2,4,6-Tribromophenol

NA Not Applicable because of the sample matrix. Analysis of this sample required a dilution such that the surrogate concentration was diluted below the MRL.

Approved by Kevin Bennett 49 Date 6-1

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Received:**	04/30/92
Project:	Rogue River/#92-SHM-181	**Date Extracted:**	05/17/92
Sample Matrix:	Sediment	**Date Analyzed:**	05/18/92
		Work Order No.:	K922775

Matrix Spike/Duplicate Matrix Spike Summary
Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Sample Name: RR-P-1*
Lab Code: K2775-1

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	Result	MS	DMS	MS	DMS	Criteria	Difference
Acenaphthene	29	28	ND	NA1	NA1	NC	NC	40-130	NC
Pyrene	29	28	910	120	110	NA2	NA2	40-130	9
Pentachlorophenol	29	28	ND	NA1	NA1	NC	NC	10-120	NC

SIM Selected Ion Monitoring

* Sample was extracted six days past the end of the recommended maximum holding time. Initial analysis, performed *within* the recommended maximum holding time, failed CAS QC criteria. The reanalysis met our QC criteria. It is the opinion of CAS that the quality of the sample data has not been significantly affected.

ND None Detected at or above the method reporting limit

NA1 Not Applicable because of the sample matrix. Analysis of this sample required a dilution such that the spike concentration was diluted below the MRL.

NC Not Calculated

NA2 Not Applicable because of the sample matrix. Accuracy of the spike recovery value is reduced, since the sample concentration was greater than 30 times the amount spiked.

Approved by _____ 50 Date 6-1

00029

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	U.S. Army Corps of Engineers	**Date Extracted:**	05/17/92
Project:	Rogue River/#92-SHM-181	**Date Analyzed:**	05/18/92
LCS Matrix:	Soil	**Work Order No.:**	K922775

Laboratory Control Sample Summary
Polynuclear Aromatic Hydrocarbons and Phenols
EPA Method 3550 in combination with GC/MS SIM Method
µg/Kg (ppb)
Dry Weight Basis

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Criteria
Acenaphthene	17	14	82	40-130
Pyrene	17	17	100	40-130
Pentachlorophenol	17	*8	47	10-120

SIM Selected Ion Monitoring
* Analyte concentration is an estimate because the result was below the instrument calibration range.

Approved by [signature] 51 Date 6-1

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APPENDIX B

CHAIN OF CUSTODY INFORMATION

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B3I9F3820P0C000

CHAIN OF CUSTODY RECORD

PROJECT: Rogue River

SAMPLERS: (Signature) Jim Britton

SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	NO. CONTAINERS	metals*	pesticides/PCBs	PAHs-GC/MS	Phenols	TBT	AVS	TOC			REMARKS OR SAMPLE LOCATION	PRESERVATION: ICED	SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
RR-P-1	4/28			X	1/2	X	X	X	X	X	X	X			} composite		
RR-P-1				X	2/2	X	X	X	X	X	X	X					
RR-P-2				X	1/2	X	X	X	X		X	X			} composite		
RR-P-2				X	2/2	X	X	X	X		X	X					
RR-P-3				X	1/2	X	X	X	X	X	X	X			} composite		
RR-P-3				X	2/2	X	X	X	X	X	X	X					
RR-P-4				X	1/2	X	X	X	X	X	X	X			} composite		
RR-P-4	↓			X	2/2	X	X	X	X	X	X	X					

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Shipped via:
① Jim Britton	4/29/92 1130	Pamela Swan	④		
② Pamela Swan	4/29/92 1500	Received by: (Signature)	Received for Laboratory by: (Signature) Toni K. H—	4/30/92 0930	Shipping Ticket No.
③ Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Remarks: see Portland District detection limits for analyses		

★ metals = As, Cd, Cr, Cu, Hg, Pb, Z

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U0032

COOLER RECEIPT FORM

Project: Rogue River

Cooler received on 4/30/92 and opened on 4/30/92 by R. Allison

1)	Were custody seals on outside of cooler ----------	(YES) NO
	If yes, how many and where? 2-Front	
	Were signature and date correct? ----------	(YES) NO
2)	Were custody papers taped to lid inside cooler? ----------	(YES) NO
3)	Were custody papers properly filled out (ink, signed, etc.)? --------	(YES) NO
4)	Did you sign custody papers in the appropriate place? ----------	(YES) NO
5)	Did you attach shipper's packing slip to this form? ----------	(YES) NO
6)	What kind of packing material was used? vermiculite	
7)	Was sufficient ice used (if appropriate)? ----------	(YES) NO
8)	Were all bottles sealed in separate plastic bags? ----------	(YES) NO
9)	Did all bottles arrive in good condition (unbroken)? ----------	(YES) NO
10)	Were all bottle labels complete (No., date, signed, anal. pres, etc.)	(YES) NO
11)	Did all bottle labels and tags agree with custody papers? ----------	(YES) NO
12)	Were correct bottles used for the tests indicated? ----------	(YES) NO
13)	Were VOA vials checked for absence of air bubbles, & noted if so?	YES NO
14)	Was sufficient amount of sample sent in each bottle? ----------	(YES) NO

Explain any discrepancies ----->

DATA REPORT

Battelle/Pacific Northwest Laboratories
Marine Research Laboratory
439 West Sequim Bay Road, Sequim, WA 98382
Phone (206) 683-4151 / Fax (206) 681-3699

Report to: Kevin DeWhitt
Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, WA 97626
Phone (206) 577-7222
Fax (206) 636-1068

Analysis: **BUTYLTINS**
Matrix: **SEDIMENT**
Report Date: 5/20/92
Central File No.: 448CAS
No. Samples: 3

SAMPLE RESULTS

BR-P-1
BR-P-2
BR-P-3

MSL Code No.	Sponsor Code No.	Sample Size (g)	Concentration (ng/g dry weight) Tributyltin	Dibutyltin	Monobutyltin
448CAS-1	K2775-1	2.720	4.4	2.6 U	5.5 U
448CAS-2	K2775-2	2.120	6.9	2.3 U	5.0 U
448CAS-3	K2775-3	2.200	9.6	4.1	8.2
448CAS-BLANK		5.000	2.2 J	2.6 U	5.5 U

SURROGATE RECOVERY

MSL Code No.	Sponsor Code No.	Tripentyltin % Recovery
448CAS-1	K2775-1	36%
448CAS-2	K2775-2	45%
448CAS-3	K2775-3	47%
448CAS-BLANK		52%

QUALITY CONTROL SAMPLE RESULTS

	Sample Type	Concentration (ng/g) Tributyltin	Dibutyltin	Monobutyltin
448-BLK SPK-1	Matrix spike	143.0	73.7	7.9
	Recovered concentration	140.8	73.7	7.9
	Spike concentration	366.0	366.0	366.0
	Recovery	38%	20%	2%
448-BLK SPK-2	Matrix spike	120.4	76.4	8.0
	Recovered concentration	118.2	76.4	8.0
	Spike concentration	366.0	366.0	366.0
	Recovery	32%	21%	2%

KEY TO CODES:
U Indicates analyte was not detected above the detection limit.
J Indicates an estimated value when result is less than specified detection limit.